

PLACE-BASED STEM EDUCATION WORKSHOP AND PLANNING MEETING IN MALAWI

George E. Glasson Josiah Tlou Virginia Tech School of Education Office of International Research, Education & Development Project InnovATE/USAID

Place-based STEM Education Workshop & Planning Meeting in Malawi: September 2015

Place-based STEM Education

- Rooted in what is local -- the unique history, environment, culture, economy, literature, and art of a particular place" – Loveland 2003
- Connects local community knowledge with science literacy
- Focus on Collaboration and Problem-Solving
- Respects and includes voice of Indigenous people





Place-based Sustainability Issues in Malawi: Deforestation



Trees cut for firewood



Traditional Slash and Burn



Charcoal Ready for Market



Indigenous Knowledge and Practice: Traditional Farmer



• Problem

- Loss of soil fertility
- High cost of synthetic fertilizers
- Solution
 - Grows crops under msangu tree
 - Leaves from msangu tree adds nutrients to the soil

Indigenous Knowledge and Practice: Traditional Food Preservation



- Problem
 - No refrigeration
 - Vegetables production varies with season
 - Cereals and legumes attacked by weevils
- Solution
 - Vegetables : Boiled and sundried
 - Preserve using ash made from certain types of trees

Place-based STEM Workshop and Planning Meeting in Malawi (September 2015)





Interdisciplinary Place-based STEM Team: Biology Teacher, Agricultural Educator, Organic Farmer



Next Generation Science Standards

Science	Engineering/Agric ulture		
Asking Questions	Defining Problems		
Developing and Using Models			
Planning and Carrying Out Investigations			
Analyzing and Interpreting Data			
Using Mathematics and Computational Thinking			
Constructing Explanations	Designing Solutions		
Engaging in Argument for Evidence			
Obtaining, Evaluating, and Communicating Information			

Place-based STEM Education at Virginia Tech

Local Community Issues

Design & Test Water Filtration Systems



Planning for Place-based STEM Education in Malawi

Local environmental and/or agricultural Issue	Science, Engineering, & Agricultural Practices	Science Core Ideas Cross cutting concepts	Community Resources	Student Activities

Issue: Food Security & Water Shortage

Community Resource: Sustainable Agriculture

Daniel Chinkhuntha: Organic Farmer Tikondwe Freedom Gardens



Traditional, low-input practices



Sunken Plots



Organic Pesticides



Msangu Tree: Fertilization



Gravity-fed & solar irrigation



Check Dams/Fish Farming

Aerial View





Global Climate Change





Place-based STEM Education: 5-E Model Lesson

Title	
Purpose/Rationale	
Science Core Ideas/Cross Cutting Concepts	
Science, Engineering, Agricultural Practices	
Materials and Community Resources	
Safety and Class Management Issues	
Engage	
Explore	
Explain	
Elaborate	
Evaluate	

20.----

5-E Model Lesson

production and the second s	1
Title	IRRIGATION ENGATERSHORTAGE
Purpose/Rationale	Address Irogation water Shortcom
Science Core Ideas	Susten & System a late
Science Engineering.	A REAL REAL
& Agricultural	
Practices	Beveloping & Using Middle
Materials and	-Thand - T Peak - Pairges
Community Resources	7 Labour - PHONES -> Mainure
	+ Tools -Pshouls + Local Farmer
Safety and Class	#tand - Giving proper instructions to 4. students
Management Issues	students on how to used the materials dance was
	dust cords, gurarboots, gborrs, weall coast basing
Procedures for Teaching	(numbered with time frame)
Engage	with writer Controp
10 min	- students to observed withing crows. the check dams of
Explore	- THIS CHAINE ALCHALING LOGICIAS & CLARGE ME DECEMMENT
	which will helps to conserve water in
Isma	the garden, an Papel
Explain (include key 26	- Part the students in groups of stand give
vocabulary/concepts as	and slanding basins
related to exploration)	3 tase non to creite
Elaborate	+ Check dense is & a property of planting basins
Inin	help plante during day spells.
Fyaluata	,
Formativa	- students will be accepted the production
roimative	bacting check dams & planting bassing in their
$ \mathcal{O} $	groups = students will be assessed in the straints where
Summative	dams & the depth of mariting basins.
	*Ash students to sammanse how best to create
10	the check dams & planting busins, +the thing to
Activity Sheet (include:	Solve the problem
safety, data recording,	(Attach to lesson plan)
open-ended questions)	

.

5-E Model Lesson: Irrigation & Water Shortage

- Purpose: to investigate causes and solutions to water shortage
- Science Core Ideas/Cross-cutting concepts: Systems and Systems Models
- Science and Engineering Practices: Developing and using models
- Materials and Community Resources: Land, Labor, Hoes, Shovels, Manure, Local Farmers
- **Engage:** Take students to a nearby garden with water shortage. Students observe wilting crops. Asking students on how to address the problem
- **Explore:** Designing planting basins and check dams which will help to conserve water in the garden (on paper).
- **Explain:** Asking students the importance of planting basins and check dams, i.e., to conserve water which will help plants during dry spells.
- **Elaborate:** Put students in groups of 5 and give them materials to use in creating check dams and planting basins. Ask them to write.

Planning for STEM Certificate for Science and Agricultural Teachers

Goals for Teacher Learning and Curriculum Development	Needs	Challenges	Ideas for Success
Develop a responsive	Qualified teacher	Institutional capacity	Using locally available indigenous
curriculum for	educators	cupucity	technologies and the
development	Stakeholder	Large classes	
Teacher equipped	participation	Limited funding	secondary schools for
knowledge and	Infrastructure	Ineffective policy	
skills on content/pedagogy	conducive for	on public-	Strong relationship between the colleges
Teacher creative in	learning.	partnerships	and teaching practice scholar
resource mobilization and practicals	Using indigenous knowledge.	Political will	

Place-based STEM Education

"We can use a community site to investigate – maybe a local market or even within the home what is the dumping site and the different types of waste..."

-Teacher Educator, Department of Teacher Education and Development, Ministry of Education

"We are looking at the root cause of the problem so the students can come up with a lasting solution"

- Secondary School Teacher, Lilongwe Girls School

"Students should be challenged to define solutions for the local issues" "Show students there is no one solution to any given problem" - Director of Secondary School Education, Ministry of Education Third Space: Connecting Indigenous (local) knowledge with modern science (STEM) with Focus on Place-based Sustainability of Ecosystems and Cultures

> Indigenous Local Knowledge & Practices First Space

Hybrid Knowledge: Place-based STEM Third Space

Modern Science: STEM Second Space

Bhabha, 1994; Wallace, 2004; Glasson et al., 2010

Connecting with traditional farming practices with science teaching in schools



www.mmp.soe.vt.edu



Distance Learning in Sub-Saharan Africa: Dr. Ndalapa Mhango



New Partnership for Africa's Development (NEPAD): Dr. Josiah Tlou







The Potential for using NEPAD to use ICT skills in:

- Teacher Education
- Teaching and learning process



- Agriculture food production and preservation
- Doing research in Science and technology
- Health related issues such as clean water and sanitation



Collaborative Place-based STEM Team



Place-based STEM Education Planning Workshop



1881







Visit our website at:

www.oired.vt.edu/innovate

InnovATE is supported by a grant from USAID and managed by Virginia Tech's Office of International Research, Education, and Development (OIRED). This project was made possible by the United States Agency for International Development and the generous support of the American people through USAID Cooperative Agreement No. AID-OAA-L-12-00002